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NEW APPLICATION TRANSMITTAL

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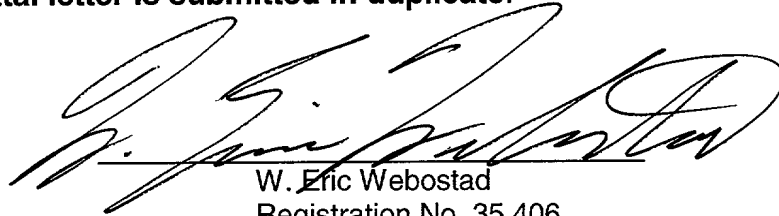For: SERVICE LEVEL AGREEMENTS AND MANAGEMENT
         THEREOF

Enclosed are:

[14]	pages of specification and cover sheet
[5]	pages of claims
[1]	pages of abstract
[6]	sheets of formal drawings.
[2]	pages of declaration and power of attorney.
[2]	pages of assignment and assignment recordation form
[ ]	pages of information disclosure statement
[ ]	page of form 1449
[ ]	references
[1]	return postcard

CLAIMS AS FILED			
	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE $760.00
TOTAL CLAIMS 15 - 20	0 x	$18.00	0.00
INDEPENDENT CLAIMS 5 - 3	2 x	$78.00	156.00
MULTIPLE DEPENDENT CLAIMS(S)	0 x	$260.00	0.00
	TOTAL FILING FEE		$916.00

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2

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APPLICATION FOR

UNITED STATES LETTERS PATENT

FOR

SERVICE LEVEL AGREEMENTS AND MANAGEMENT THEREOF

BY

Himanshu S. Sinha

Certification Under 37 CFR 1.10

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1   TITLE OF THE INVENTION

2   SERVICE LEVEL AGREEMENTS AND MANAGEMENT THEREOF

3   FIELD OF THE INVENTION

4   The present invention generally relates to information technology, and more

5   particularly relates to managing one or more services for forming and complying with

6   service level agreements.

7   BACKGROUND OF THE INVENTION

8   Recent technological advances combined with market forces have resulted in the

9   creation of new services composed of other services. The term "composite service" is

10   used to describe these new services. Composite service providers pull together a plurality

11   of component services to provide a composite service. Composite services

12   conventionally span several participant organizations. Terms such as "virtual enterprise"

13   and "virtual organization" are conventionally used to describe this type of collection of

14   organizations. A participant organization may provide component services to one or more

15   virtual enterprises. Each component service provider implements a service by executing

16   a process. Implementation of a composite service requires execution of a process that

17   spans multiple organizations. The execution of such multi-organizational processes

18   conventionally involves interaction among participant organizations' computer systems.

19   By way of example and not limitation, today there are virtual enterprises reselling

20   web search services. Such virtual enterprises receive a query from a user. This query is

21   then used to query selected web search services offered by component service providers

22   of which this virtual enterprise is a client.

1   Referring to the block diagram of FIG. 1, a group of component service providers'

2   computer systems 20 comprise component service providers 20a and 20b. Component

3   service providers 20a and 20b have respective service implementations 19j and 19k.

4   Service implementations 19j and 19k may be put in communication with composite

5   service providers 10a and 10b of a group of composite service providers' computer

6   systems 10. Each composite service provider 10a and 10b may have one or more client

7   processes 13m to 13n and 13q to 13p, respectively.

8   Continuing the above-mentioned example, suppose a user of composite service

9   provider 10a places a query for a World Wide Web search. This query invokes client

10   process 13m causing a request to be sent to service implementations 19j and 19k for

11   searching the World Wide Web using respective search engines associated with these

12   services. Results from such searches may then be provided from service implementations

13   19j and 19k to client process 13m. Hence, in this example, a user executes separate

14   searches on separate search engines of separate service providers from a single query on

15   another separate service provider.   In other words, a composite service provider executes

16   a business process which in turn causes component service providers to execute

17   respective business processes.

18   Accordingly, it should be understood that a component service provider may have

19   several services to offer its clients. Thus, component service providers may have a

20   platform of services available to subscribers or clients. Such services may be invoked

21   through various invocation infrastructures such as Common Object Request Broker

22   Architecture ("CORBA"), Java Remote Method Invocation ("Java RMI"), Hypertext

23   Transport Protocol ("HTTP"), among others. Moreover, this invocation may be manual;

1   for example, a phone call from a composite service provider representative to a

2   component service provider representative.

3   In the telecommunications field, Competitive Local Exchange Carriers (CLECs)

4   resell local telephone service of Incumbent Local Exchange Carriers (ILECs). Thus, a

5   CLEC may offer services of several ILECs of which it is a client and vise versa. In a

6   CLEC business model, there is interaction between ILEC and CLEC business processes.

7   By way of example and not limitation, a CLEC customer service representative may

8   interact with provisioning ILEC processes to place an order, inquire about an order, or to

9   cancel an order.

10   Accordingly, with respect to the above-mentioned Internet example and

11   telecommunications example, in order to offer their selection of services, a composite

12   service provider relies on services of its component service providers. Therefore, it is

13   incumbent upon composite service providers as clients of component service providers to

14   enter into agreements to guarantee that service needs are met. Examples of such

15   guaranteed service needs may include maximum response time and minimum throughput.

16   These agreements are referred to hereinafter as Service Level Agreements (SLAs). SLAs

17   also assist component service providers in managing their resources to meet their client's

18   needs. Without such SLAs, a component service provider may be overwhelmed by

19   requests from one client organization, which can affect service level to other clients.

20   SLAs pertain to services at an application level, as distinguished from end-to-end

21   quality of service (QoS). QoS conventionally pertains to quality parameters of a system

22   infrastructure, or more particularly network performance. A taxonomy of QoS may be

1   found in "Taxonomy of QoS Specifications," by Bikash Sabata, *et al.*, *Proceedings of*

2   *WORDS '97*, February 1997.

3   Quality objects, which are described in more detail in "Specifying and Measuring

4   Quality of Service in Distributed Object Systems," by Joseph P. Loyall, *et al.*,

5   *Proceedings of ISORC '98*, April 1998, facilitate specification monitoring of QoS

6   contracts between clients and service providers.   However, this specification monitoring

7   is directed at service implementation details and not invoked functionality. Moreover, in

8   QoS contracts, a client is required to specify resource requirements. However, a client

9   may have limited knowledge of resource usage of an invoked service.

10   A QoS web server is described in "Supporting Quality of Service in HTTP

11   Servers," *Proceedings of the Seventeenth Annual SIGACT-SIGOPS Symposium on*

12   *Principles of Distributed Computing*, June 1998. This QoS web server allows allocation

13   of server resources to specific web page requests. System capacity is represented by an

14   estimate of bytes per second served by the server. Thus, issues of guarantees to clients

15   are not addressed.

16   A product called "SilkMeter" from Segue Software, Inc. of Lexington,

17   Massachusetts, is a software system for supporting usage control in CORBA

18   environments. SilkMeter supposedly controls object usage and access based upon

19   customer-defined usage policies, and provides metering capabilities allowing software

20   owners to monitor usage activity and to bill users accordingly. However, SilkMeter does

21   not support implementation of SLAs.

22   Hewlett-Packard Company of Palo Alto, California, has announced a web QoS

23   strategy. In this announced strategy, website operators may create classes of users with

4

1   priorities assigned to each class, and more particularly operators may create service

2   classes and allocate capacity to each of them. However, this strategy falls short of

3   providing mechanisms that allow organizations to enter into SLAs. For example, in this

4   strategy, if two organizations are at the same priority level, then it is possible that

5   requests from only one of them will be serviced.

6   Accordingly, it would be desirable to provide specification and fulfillment thereof

7   for SLAs between organizations. Advantageously, it would be desirable for such SLA

8   specification and fulfillment to be applicable to a variety of services and implementations

9   and to facilitate deployment over existing distributed system infrastructures.

10 SUMMARY OF THE INVENTION

11 An aspect of the present invention is a service level agreement manager. Such a

12 service level agreement manager is disposed between one or more client process run on

13 one or more computer systems and a service implementation run on one or more other

14 computer systems. Moreover, a client process may be a service implementation. Such a

15 service level agreement manager comprises an admission controller, a performance

16 measurement module and a specification module.

17 Another aspect of the present invention is a method for service level formation.

18 More specifically, a specification module of a service level agreement manager is

19 invoked. Performance information is obtained from a performance measurement module.

20 A client provides anticipated usage information for a target service. The performance

21 information and usage information is compared to determine if a basis for forming a

22 service level agreement exists.

1   Another aspect of the present invention is a method for managing system

2   performance. More specifically, a service level agreement manager determines whether a

3   client's request is within the scope of a service level agreement. For example, it may be

4   determined whether a request is within the scope of a service level agreement in effect

5   between a requesting client and a service provider of a service implementation for which

6   this client's request is targeted. If the request is within the scope of the service level

7   agreement, the service level agreement is provided to a performance measurement

8   module and to a service organization's service implementation. Results are then obtained

9   from this service implementation in response to this request. Performance parameters

10   associated with sending a request from and receiving a response to a service level

11   agreement manager may be measured. These performance parameters may then be check

12   against performance parameters agreed to in the service level agreement.

13   Advantageously, a service level agreement manager in accordance with the

14   present invention may be independent of service implementation with respect to

15   compatibility issues. Such a service level agreement manager need not directly monitor

16   or measure resource usage of a service provider, rather it can measure response

17   performance therefrom. Moreover, any of several well-known optimization technique

18   can be used within such a service level agreement manager. Furthermore, such a service

19   level agreement manager may be used with any of a variety of invocation infrastructures.

20   These and other features, advantages, objects and embodiments of the present

21   invention will become more apparent from reading the following Detailed Description of

22   the Preferred Embodiments or by practicing the present invention.

1   DESCRIPTION OF THE DRAWINGS

2   The features of the present invention, as well as objects and advantages, will best

3   be understood from reading the appended claims, detailed description and accompanying

4   drawings where:

5   FIG. 1 is a block diagram of a group of component service providers of the prior

6   art.

7   FIGS. 2, 2A and 2B are block diagrams of exemplary embodiments of networks

8   in accordance with the present invention.

9   FIG. 3 is a flow diagram of an exemplary embodiment of SLA formation in

10   accordance with the present invention.

11   FIG. 4 is a flow diagram of an exemplary embodiment of SLA usage in

12   accordance with the present invention.

13   In the drawings, same reference numbers refer to like components throughout the

14   several figures.

15   DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

16   In the following detailed description, reference is made to the accompanying

17   drawings which form a part of this detailed description, and in which, shown by way of

18   illustrative example, specific embodiments are described. These embodiments are

19   described in sufficient detail to enable those of skill in the art to practice the present

20   invention. However, it is to be understood that other embodiments of the present

21   invention not described herein in detail may be utilized. Therefore, the following

22   detailed description is not to be taken in a limiting sense.

1   Referring to FIG. 2, there is shown a block diagram of an exemplary embodiment

2   of a system 200 in accordance with the present invention. SLA manager 110 may be put

3   into or is in communication with one or more client computer systems ("clients") 100.

4   As illustratively shown, SLA manager is in communication with clients 100a and 100b.

5   Clients 100 may comprise one or more composite service providers, as described

6   elsewhere herein and may comprise one or more computer systems for running one or

7   more client processes. By communication, it is meant electrical, optical, transverse

8   electromagnetic wave, among other forms of communication.

9   SLA manager 110 may be put into or is in communication with a service provider

10   120. A service provider 120 provides service implementation 119. Service provider 120

11   is a component service provider, as described elsewhere herein, and may comprise one or

12   more computer systems for running service implementation 119.

13   Accordingly, it should be appreciated that SLA manager may contemporaneously

14   manage more than one client 100.

15   SLA manager 110 provides a front-end for service implementation 119. SLA

16   manager 110 comprises admission controller 113, performance measurement module

17   111, and specification module 112.

18   Referring to FIG. 2A, there is shown a block diagram of an exemplary

19   embodiment of a system 210 in accordance with the present invention. System 210

20   comprises clients 100a through 100d, SLA managers 110a and 110b, and service

21   providers 120a and 120b. Service providers 120a and 120b comprise respective service

22   implementations 119a and 119b. One or more invocation infrastructure 211 may be used

23   for connectivity between clients 100a through 100d and SLA manager 110a and 110b.

1   Accordingly, it should be appreciated that SLA managers 110a and 110b may be used

2   with any invocation infrastructure 211. Moreover, it should be appreciated that a client

3   100a may be able to access more than one service implementation, such as service

4   implementations 119a and 119b, by using respective SLA managers, such as SLA

5   managers 110a and 110b. Moreover, it should be appreciated that service providers 120a

6   and 120b may be a same provider.

7   Referring to FIG. 2B, there is shown a block diagram of an exemplary

8   embodiment of a system 220 in accordance with the present invention. Client 100a may

9   access one or more of service implementations 119c through 119e via respective SLA

10   managers 110c through 110e. As illustratively shown, a service implementation may be

11   coupled to a SLA manager downstream from a client and may be coupled to one or more

12   SLA managers farther downstream from the client. For example, service implementation

13   119 is couple to SLA manager 110a which is downstream from client 100a, and it is

14   coupled to SLA managers 110c and 110d which are further downstream from client 100a

15   than SLA manager 110a.

16   With continuing reference to FIG. 2, and additional reference to FIG. 3 where

17   there is shown a flow diagram of an exemplary embodiment of SLA formation in

18   accordance with the present invention, SLA formation is described.

19   At 301, a client 100a is put in communication with SLA manager 110. This

20   communication may be off-line or on-line. By off-line, it is meant a representative of a

21   client is in contact with a representative of a SLA manager, for example by calling a toll

22   free number to place an order. By on-line, it is meant that a client has contacted a SLA

1   manager using an invocation infrastructure, for example by accessing a web page for this

2   SLA manager and inputting requested information.

3   At 303 SLA specification module 112 is invoked. At 305, SLA specification

4   module 112 accesses performance information from performance measurement module

5   111. At 304, a service provider 120 presents a list of offered services or functions to a

6   client 100a, and client 100a specifies its usage parameters for each offered service it

7   selects. Examples of usage parameters include but are not limited to total number of

8   concurrent users, selected services or functions, among others. For services selected, a

9   client may specify peak invocation rate and average invocation rate. By invocation rate,

10   it is meant the number of invocations of a service per unit of time.

11   At 306, performance information obtained at 305 is compared with service(s)

12   selected and associate usage information obtained at 304 to determine if a basis for a

13   SLA exists. In this context, a basis for such a SLA is availability of resources to satisfy a

14   specified request.

15   If at 306 a basis for a SLA agreement exists, at 307 client 100a and one or more

16   service providers 120 may enter into a SLA agreement. SLA specification information

17   associated with a resulting SLA agreement is provided to admission controller 113 at

18   308.

19   If at 306 there is no basis for agreement, then a reply is sent to client 100a that

20   client provided usage parameters for identified selected services are in excess of service

21   provider's capacity.

1   With continuing reference to FIG. 2 and additional reference to FIG. 4, where

2   there is shown a flow diagram of an exemplary embodiment of SLA use in accordance

3   with the present invention, processing a service request using a SLA is described.

4   At 402, admission controller 113 determines if a request from client 100a, for

5   example, is received. If a request is received, then using an existing SLA associated with

6   this received request, admission controller 113 determines whether to accept or reject

7   such request at 403. Admission controller 113 may be configured to maximize a

8   customizable benefit function to one or more service providers 120. By way of example

9   and not limitation, this may entail allocation of resources to clients in accordance with

10 SLAs between clients and service providers. Accordingly, this decision by admission

11 controller 113 may include factors such as impact on SLAs with other clients, potential

12 benefits of servicing a request, potential penalty in rejecting a request, among others.

13   In an embodiment, a measurement and learning based implementation is used.

14 SLA manager 110 makes an initial estimate of system capacity by measuring system

15 performance under a simulated load. Thereafter, SLA manager 110, through use of

16 performance measurement module 111, continues to measure actual performance of one

17 or more service implementations to refine this initial estimate of the fraction of capacity

18 used by each function. Examples of performance measurements that may be used include

19 requests served per unit of time, bytes served per unit of time, and response time.

20   By way of example and not limitation, suppose response time is used as a

21 performance indicator. Each function f_i in the interface of a service implementation is

22 associated with a range of time. This range of time denotes minimum and maximum

23 response time for this function. An initial estimate of system capacity may be generated

1   by determining a maximum number of concurrent instances of f_i that can be executed

2   within an acceptable response time. These measurements may further be used to

3   determine the fraction of total capacity consumed by each invocation of f_i.

4   Accordingly, SLA manager 110 has opportunity to learn access patterns of its

5   clients, so an estimate, improved over that simulated by SLA manager 110, of their usage

6   variations may be expressed. SLA manager 110 can learn performance of one or more

7   service implementations under different combinations of functions invoked by clients.

8   This information may be used in combination with well-known optimization techniques

9   to improve service. Some optimization techniques that may be used are found in

10   "Reinforcement Learning for Call Admission Control and Routing in Integrated Service

11   Networks," by Peter Marbach *et al.*, in *Advances in Neural Information Processing*

12   *Systems*, vol. 10, the MIT Press, 1998.

13   Capacity of a service provider is denoted by a number of tokens. Each client

14   organization is assigned tokens to cover its SLA manager interaction with an associated

15   service provider. This assignment is managed within SLA manager 110, so it is

16   transparent to clients 100. A product called "Measureware" from Hewlett-Packard

17   Company of Palo Alto, California, for resource usage monitoring or a product called

18   "VAM Capacity Planner" from Zitel Corporation of Freemont, California, for capacity

19   planning, may be used to obtain an estimate for tokens needed for a request. Moreover,

20   these software tools may be used to aid in determining causes of violation of SLAs.

21   However, use of either or both of these software tools is optional.

22   At 403, admission controller 113 accepts or rejects an incoming request R_i. So

23   when a request of type R_i from client 110a is provided to an SLA manager 110,

1   admission controller 113 checks if there is a sufficient number of available tokens in

2   client 100a's account. If a sufficient number of available tokens exists in client 100a's

3   account, request R_i is accepted and the number of tokens needed for R_i is deducted from

4   client 100a's account. When request R_i is completed, this number of tokens deducted is

5   credited back to client 100a's account. However, if a sufficient number of available

6   tokens does not exist in client 100a's account at the time request R_i is received, then this

7   request is denied, and this denial is provided to client 100a at 404.

8   If request R_i is accepted at 403, then this request is provided to performance

9   measurement module 111 at 405. Performance measurement module 111 provides

10   request R_i to service implementation 119. At 406, request R_i is invoked for service

11   implementation 119. At 407, in response to this request, results are obtained from this

12   service implementation selected and provided to performance measurement module 111.

13   Performance measurement module 111 records performance measurements associated

14   with execution of this request at 408. Optionally, at 408, performance measurement

15   module 111 may further check performance measurements against SLA specification

16   requirements. At 409, results obtained in response to request R_i are provided from SLA

17   manager 110 to a client, such as client 100a, originating this request.

18   Although the present invention has been particularly shown and described with

19   respect to certain embodiments thereof, including without limitation a best mode if any, it

20   should be readily apparent to those of skill in the art that various structural, logical,

21   electrical, and other changes in form and detail may be made to these embodiments

22   without departing from the scope of the present invention as set forth in the appended

1   claims. Accordingly, the present invention is defined only by the appended claims that

2   follow this detailed description.

1   CLAIM OR CLAIMS

2

3   What is claimed is:

4

5   1.   In a system having a client computer system and a service provider computer

6   system programmed with a service implementation, an apparatus comprising:

7   a service level agreement manager disposed between the client computer system

8   and the service implementation, the service level agreement manager comprising:

9   an admission controller configured to control admission of the client

10   computer system to the service implementation using a service level agreement;

11   a performance measurement module in communication with the admission

12   controller and configured to measure performance of the service implementation;

13   and

14   a specification module in communication with the admission controller

15   and with the performance measurement module.

16

17   2.   The apparatus of Claim 1, wherein the specification module is configured to

18   compare service implementation performance data and client usage information.

19

1   3.   A method for service level formation, comprising:

2   providing a client computer system;

3   providing a service level agreement manager, the service level agreement

4   manager having an admission controller, a specification module and a performance

5   measurement module;

6   establishing communication between the client computer system and the service

7   level agreement manager;

8   invoking the specification module of the service level agreement manager;

9   obtaining performance information from the performance measurement module;

10   obtaining usage information associated from the client; and

11   comparing the performance information and the usage information to determine if

12 there exists a basis for forming a service level agreement.

13

14 4.   The method of Claim 3, further comprising:

15   forming the service level agreement; and

16   providing the admission controller with specification information from the service

17 level agreement formed.

18

1   5.   A method for managing system performance, comprising:

2   providing a service level agreement manager;

3   providing a client organization;

4   providing a service organization;

5   forming a service level agreement between the client organization and the service

6   organization;

7   receiving a request from the client organization to the service level agreement

8   manager;

9   with the service level agreement manager,

10   determining if the request is within the scope of the service level

11 agreement;

12   if the request is within the scope of the service level agreement, providing

13 the request to a performance measurement module and to the service

14 organization;

15   obtaining a result from the service organization in response to the request;

16   taking at least one performance measurement associated with performance

17 response of the service organization to the request; and

18   checking the at least one performance measurement taken against the

19 service level agreement.

20

21   6.   The method of Claim 5, further comprising recording the at least one performance

22 measurement.

23

1   7.   The method of Claim 6, further comprising providing the result obtained to the

2   client.

1   8.   A network, comprising:

2   a plurality of client processes;

3   a plurality of service level managers;

4   at least one invocation infrastructure for communication between the plurality of

5   client processes and the plurality of service level managers; and

6   each service level manager of the service level managers in communication with a

7   respective service implementation.

8

9   9.   The network of Claim 8, wherein the invocation infrastructure comprises a

10   Common Object Request Broker Architecture.

11

12   10.   The network of Claim 8, wherein the invocation infrastructure comprises Java

13   Remote Method Invocation.

14

15   11.   The network of Claim 8, wherein the invocation infrastructure comprises

16   Hypertext Transport Protocol.

17

1   12.   A network, comprising:

2   a client process;

3   a first plurality of service level managers;

4   at least one invocation infrastructure for communication between said first

5   plurality of service level managers and said client process;

6   each service level manager of said first plurality of service level managers in

7   communication with a respective service implementation of a first plurality of service

8   implementations;

9   each said service implementation of said first plurality of service implementations

10   in communication with at least one service level manager of a second plurality of service

11   level managers; and

12   each service level manager of said second plurality of service level managers in

13   communication with a respective service implementation of a second plurality of service

14   level implementations.

15

16   13.   The network of Claim 12, wherein the invocation infrastructure comprises a

17   Common Object Request Broker Architecture.

18

19   14.   The network of Claim 12, wherein the invocation infrastructure comprises Java

20   Remote Method Invocation.

21

22   15.   The network of Claim 12, wherein the invocation infrastructure comprises

23   Hypertext Transport Protocol.

1   SERVICE LEVEL AGREEMENTS AND MANAGEMENT THEREOF

2

3   ABSTRACT OF THE DISCLOSURE

4

5   Method and apparatus for service level agreement formation and management is

6   described. More particularly, a service level agreement (SLA) manager is described.

7   This SLA manager comprises an admission controller, a specification module and a

8   performance measurement module. Such SLA manager is interposed between one or

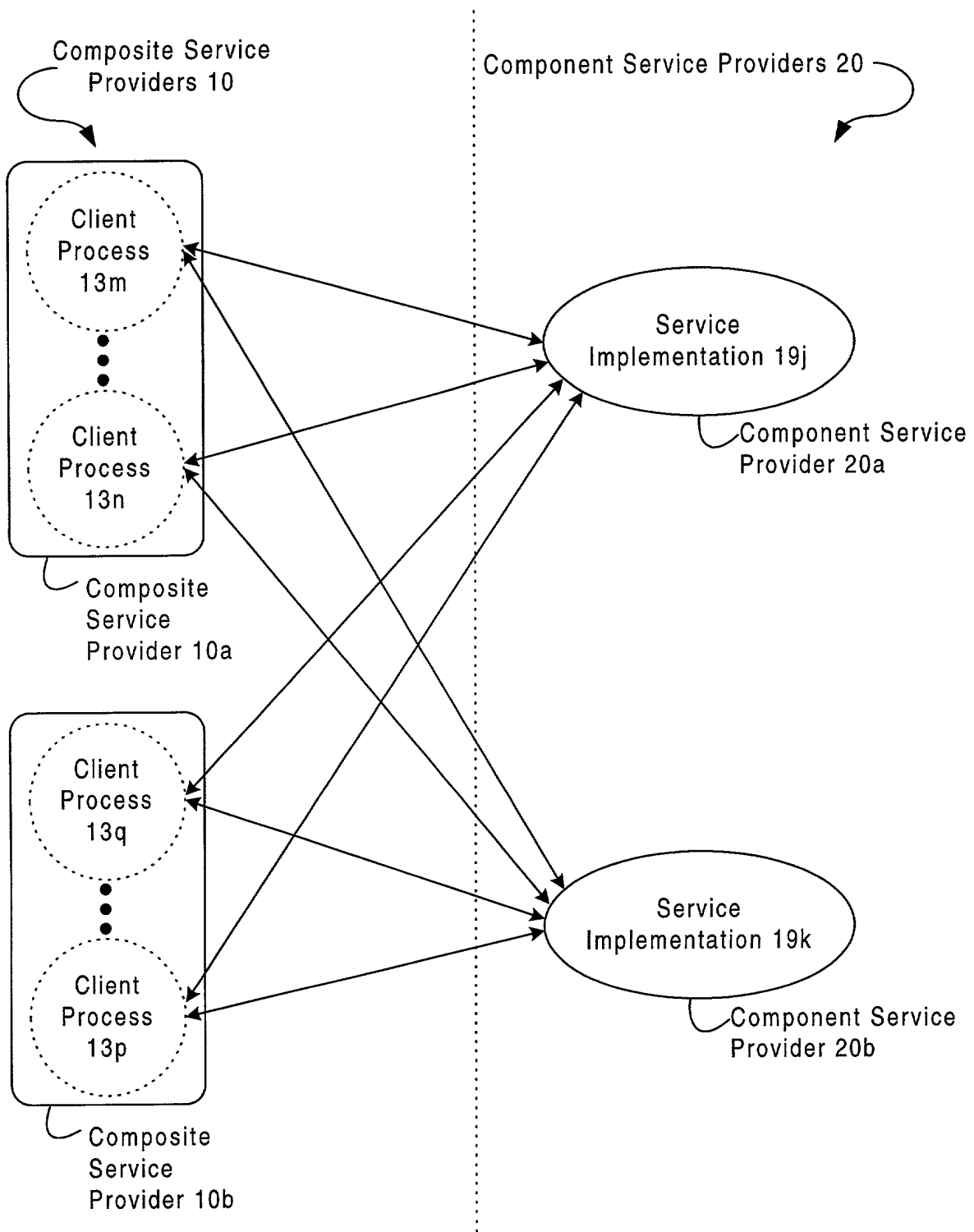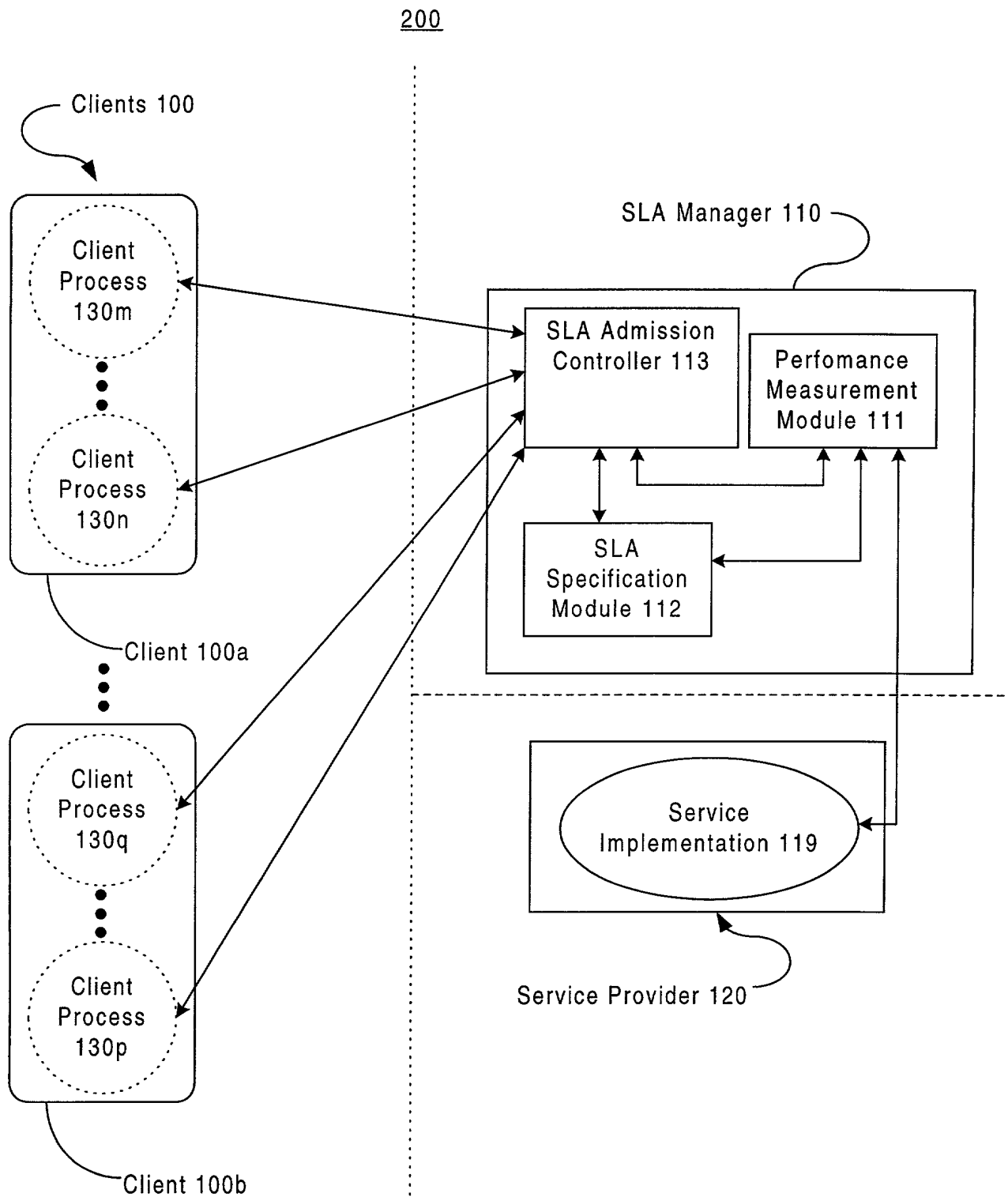9   more client computer systems and a service provider computer system.

Composite Service
Providers 10

Component Service Providers 20

Composite Service
Provider 10a

Client
Process
13m

Client
Process
13n

Service
Implementation 19j

Component Service
Provider 20a

Client
Process
13q

Client
Process
13p

Composite
Service
Provider 10b

Service
Implementation 19k

Component Service
Provider 20b

FIG. 1 (Prior Art)

Clients 100

Client
Process
130m

Client
Process
130n

Client 100a

Client
Process
130q

Client
Process
130p

Client 100b

SLA Manager 110

SLA Admission
Controller 113

Perfomance
Measurement
Module 111

SLA
Specification
Module 112

Service
Implementation 119

Service Provider 120

FIG. 2

210

100a

100b

100c

100d

211

110a ———— 119a

120a

120b

110b ———— 119b

FIG. 2A

220

100a

110a ———— 119a

110b ———— 119b

110c ———— 119c

110d ———— 119d

110e ———— 119e

FIG. 2B

```
Client in
communication
with SLA Manager
301
```

```
Invoke SLA
Specification
Module
303
```

```
Client provided with
service info. and client
selects service(s) and
provides usage info.
304
```

```
Access information
from Performance
Measurement Module
305
```

Yes ← Basis to agree
on an SLA?
306 → No

```
Client and Service
Provider Enter into
SLA
307
```

```
Reply to Client
reason
no basis for
agreement
could be found
309
```

```
Provide SLA
Admission
Controller with
information from
SLA
308
```
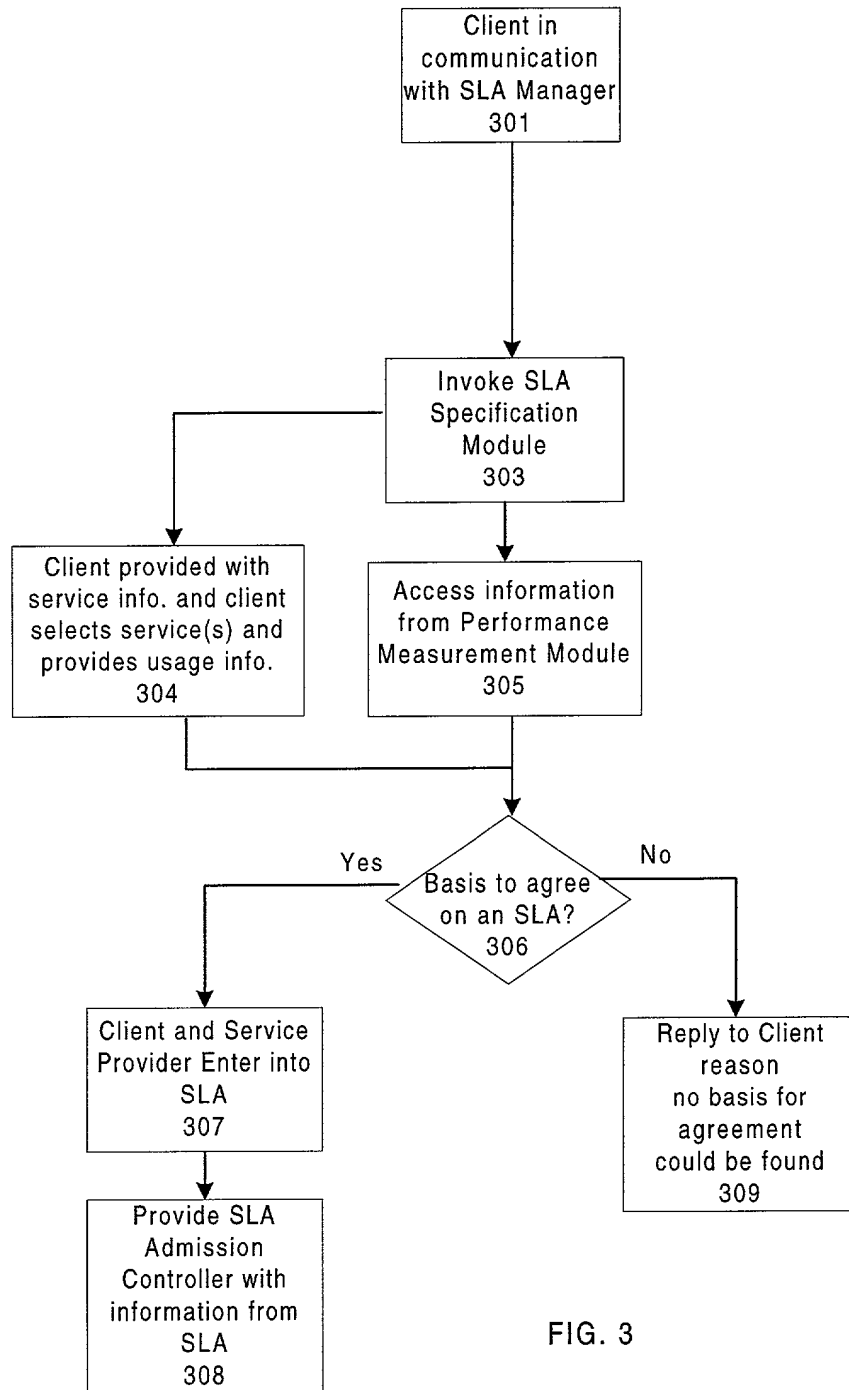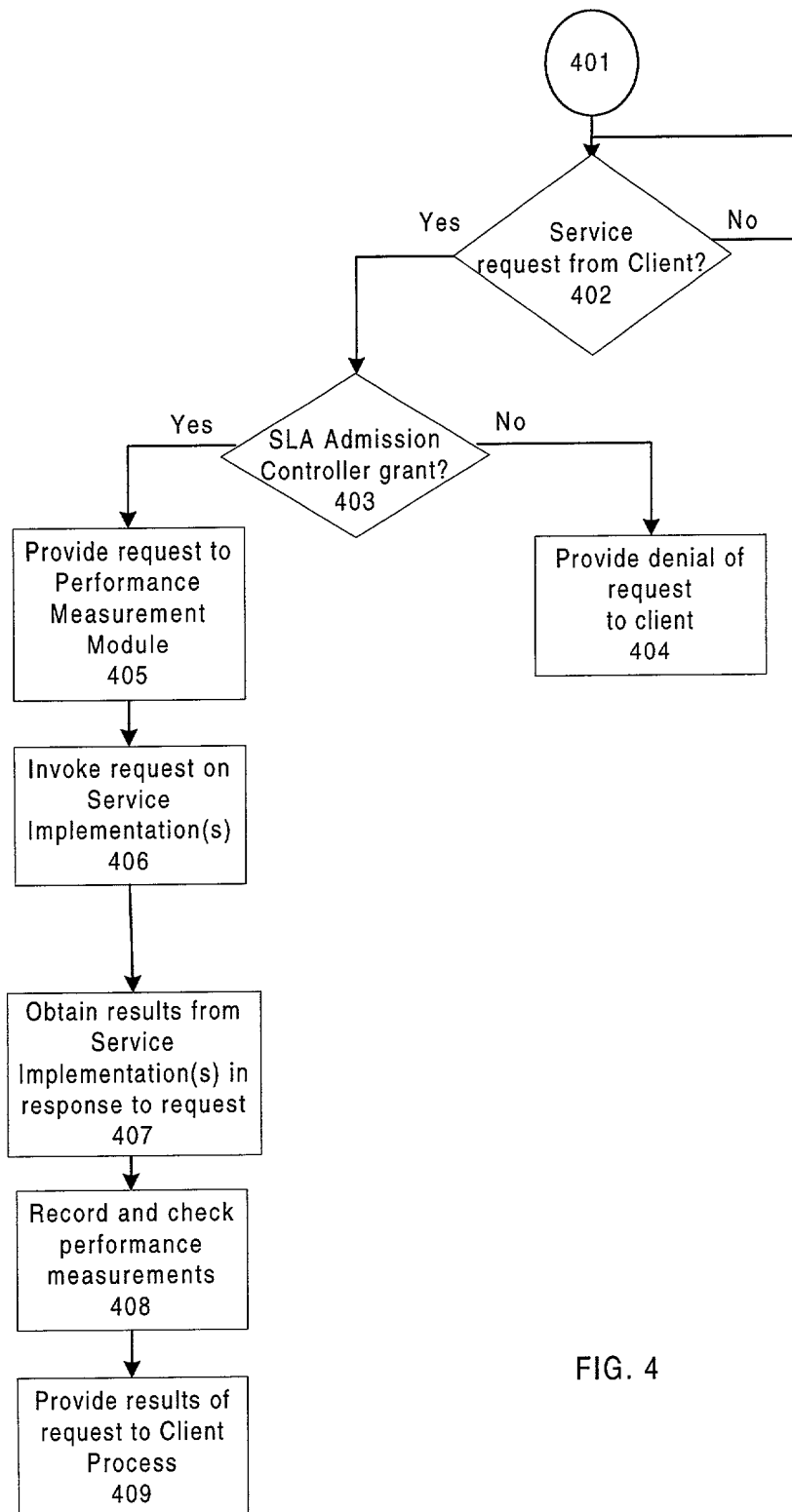
FIG. 3

FIG. 4

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

Attorney Docket No. **99-829**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SERVICE LEVEL AGREEMENTS AND MANAGEMENT THEREOF

the specification of which (check one) [X] is attached hereto. [ ] was filed on
as Appln. Serial No.   and was amended on
(if applicable). I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)   Priority Claimed
                                                                     [_] Yes [_] No

(Number)   (Country)   (Day/Month/Year filed)

I hereby claim the benefit under Title 35, United States Code, 119(e) of any United States provisional applications(s) listed below.

(Application Number)   (Filing Date)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date for this application:

(Appln. Serial No.)   (Filing Date)   (Status--patented, pending, abandoned)

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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Irving, TX 75038

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

FULL NAME OF SOLE OR FIRST INVENTOR   **Himanshu S. Sinha**

Inventor's signature _Himanshu S. Sinha_   Date   10/22/99

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